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**Gender segregation in education and employment and its relationship with the gender pay gap**

# The narrowing gender pay gap: evidence from Canada

**Note by the Statistics Canada[1]**

*Summary*

Canadian results reveal significant differences between the female-male ratio in hourly wages and the ratio based on annual earnings. The wage ratio reveals that women have continued to make progress over the last 25 years while the earnings ratio has remained stagnant.

Although men continue to earn more than women, the ratio of women's wages to men's improved by 7.6 percentage points between 1988 and 2008. The first main finding – that is, the growth in women's wages (+11.5 per cent) outpaced that of men (+1.3 per cent) - suggests that the changing composition of the labour force and changes in how the labour market compensates workers played a role in reducing the gender wage gap. The second major finding – that is, the wages of men and women did not diverge as they aged as they had in the past – suggests that part of the improvement in the ratio is simply because the gap is smaller in newer cohorts than in older ones. These findings stress the importance of 'starting off right' since the wage gap at age 25-29 is a good predictor of the gap throughout a generation's working life.

[1] Prepared by Marie Drolet.

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# I. Introduction

1. The fact that men continue to earn more than women is not new in Canada. It is a complex issue that demands not only frequent re-examination but also requires analysis from a number of different perspectives.

2. The gender wage gap not only affects Canadian women but entire families are impacted by women's earnings. The publication *Women in Canada 2011* reports that the incidence of dual–income families has increased from 47 per cent of husband–wife families in 1976 to 64 per cent by 2008. The incidence of husband-wife families in which the wife earned more than their husbands has also grown from about 12 per cent in 1976 to 29 per cent in 2008.

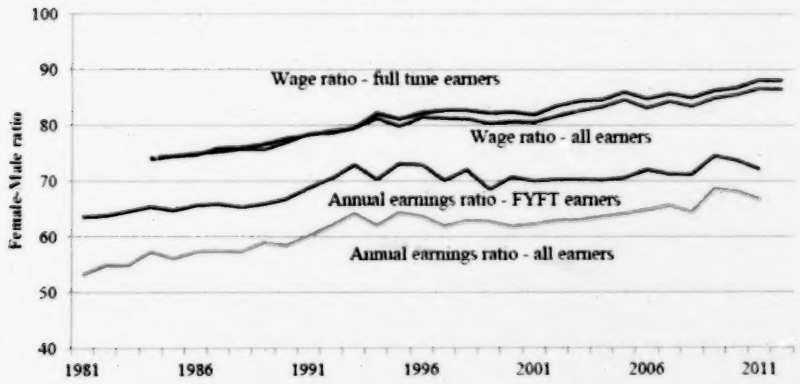
3. Numerous studies have added to our understanding of gender earnings differentials in the Canadian context by documenting the importance of work experience (Kidd and Shannon 1997; Drolet, 2002a), the role of the workplace (Drolet 2002b); the importance of occupational gender segregation (Baker and Fortin, 2001; Fortin and Huberman, 2002); the consequence of measurement issues such as the unit of earnings, analytic methods, model specifications and population (Drolet, 2001; Baker and Drolet forthcoming). Very few Canadian studies have documented the change in the earnings differential over time (Baker and Drolet, 2010; Drolet, 2011).

4. In spite of the importance of women's economic contributions to their families' wellbeing, the gender wage gap persists.

# II. Canadian evidence on Gender Pay Ratios

5. For over 30 years, Statistics Canada has provided a consistent time series of the female-male pay ratio based on the annual earnings of full-year full-time workers (FYFT). As Chart 1 makes clear, the earnings ratio made modest improvements until the late 1980s but has been holding steady at 0.71 since the early 1990s (Baker and Drolet, 2010).

**Chart 1: Gender compensation ratios, 1981-2012, Age 25-54 , CANADA**




*Source:* Updated results using Figure 1 from Baker and Drolet (2010). Annual earnings data for 2009-2011 from Cansim Table 202-0102. Hourly wage rate data for 2009-2012 from Labour Force Survey, Cansim Table 282-0072.

6. Restricting attention to annual earnings FYFT workers does not ensure that equal quantities of work are being compared. Earnings are a product of prices (wages) and quantities (hours worked). An earnings gap may exist simply because full-time men work longer hours than full-time women. In fact, evidence from the Labour Force Survey (LFS) documents that men employed full-time usually work 42.2 hours per week while women employed full-time worked 38.7 hours per week – a difference of 3.5 hours in 2008.

7. Restricting attention to annual earnings FYFT workers excludes a large and changing segment of the population According to the LFS, roughly 63per cent of women work FT in 2008. This is up from 52per cent in 1988. The proportion of men working full-time has dropped from 85.2 per cent in 1988 to 80.5 per cent in 2008. The fact that employment rates have fallen among men while those among women have increased may be associated with selection issues. This issue is addressed later when the trends in the GWG is analysed more thoroughly.

8. Earlier work in Canada (Drolet 2002a) suggested that the wrong metric was being used to monitor the gender pay gap. A more appropriate unit of measurement would be hourly wages since wages correspond more closely to the price of labour.

9. Piecing together wage data from various surveys starting in 1981, Baker and Drolet (2010) construct a consistent time series of the gender wage ratio in Canada. Chart 1 shows that the gender wage ratio is different from the gender earnings ratio in both level and trend. First, looking at the horizontal distance or the difference in the levels between the two series reveals that the earnings based ratio is about 10-15 percentage points lower than the wage ratio throughout the series. In 2011, the wage based ratio was 0.86 while the earnings based ratio was 0.72. Second, looking at the trend in the two series reveals that the earnings ratio remains stagnant since the early 1990s while the wage ratio shows modest yet steady improvements.

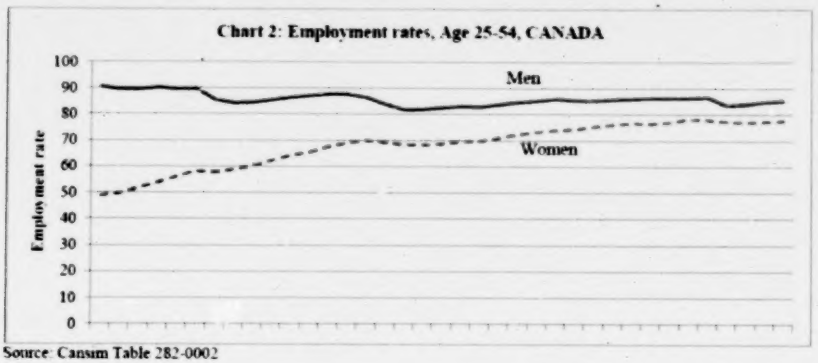
## III. Women in the Canadian Labour Market

10. Over the past few decades, major economic, social and demographic changes have brought about major changes in the composition of the Canadian labour market. One of the most fundamental changes has been the massive influx of women into the paid workforce. Chart 2 shows that the gap in employment rates of men and women is now much smaller than it was in the past: the share of women employed was about 37 percentage points below that of their male counterparts in the late 1970s and by 2008 the gap reduced to about 8 percentage points. In 2008, about 4 in 5 women between the ages of 25 and 54[2] participated in the labour market[3]. That year, women accounted for almost one-half of all paid employees in Canada[4].

[2] The analytical sample of interest is paid workers aged 25-54. The age restrictions address important economic and social trends that may change the composition of the sample. By age 25 most individuals have completed their schooling while the trend towards early retirement is not significant before age 55.

[3] Cansim Table 282-0020.

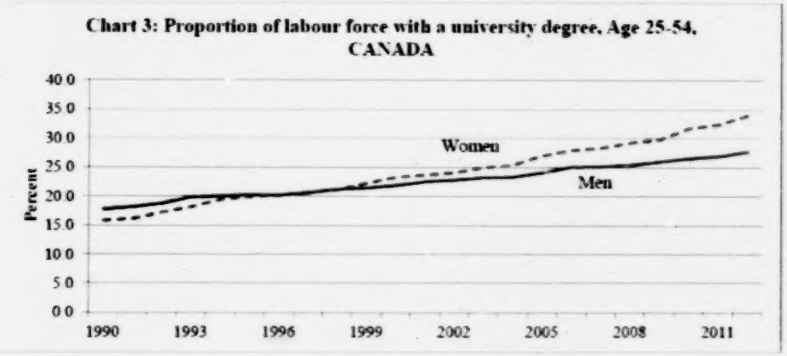
[4] Author calculations from Cansim Table 282-0020.




Source: Cansim Table 282-0002

11. But it is the changing *relative* position of men and women in the Canadian labour market that can be linked to their labour market outcomes, namely wages. Three notable trends are documented.

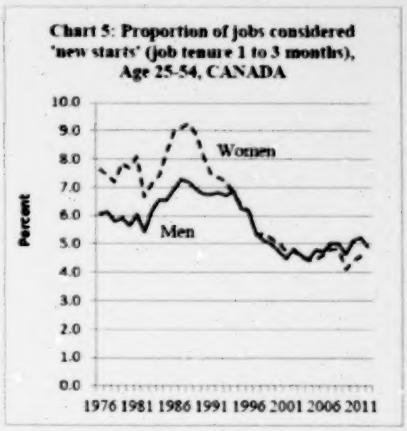
12. First is the changing **educational investment** of women. The educational attainment of women has been increasing in recent decades and now surpasses that of men. For example, the proportion of women in the labour force that held a university degree rose from 15.7 per cent in 1990 to 29.2 per cent in 2009 (Chart 3). The corresponding numbers for men are 17.7 per cent and 25.3 per cent. In 2008, 62 per cent of undergraduate degrees and 54 per cent of graduate degrees were granted to women.




*Source:* Updated from Chart C in Drolet (2011). Statistics Canada, Labour Force Survey, Cansim Table 282-0004.

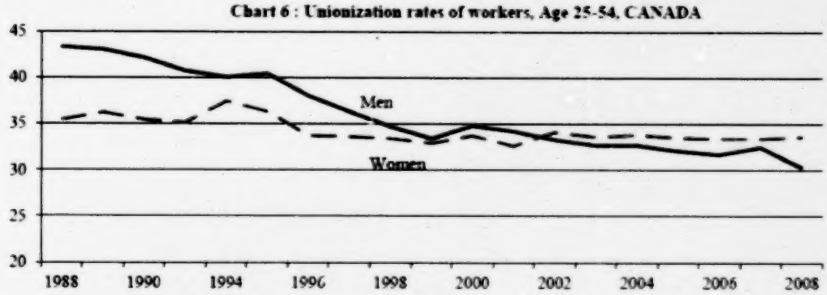
13. **Job tenure** is another case in point. The gender difference in 'in-progress' job tenures fell from over 30 months in 1978 to less than 5 months in 2008 (Chart 4). This is due to an increase in the average tenure among women: from 68.1 months in 1978 to 92.7 months in 2008. As well, women were more likely to be in jobs that just started (1-3 months) than men until the early 1990s. After that point, there is no appreciable gender difference (Chart 5).

Source: Updated from Chart A in Drolet (2011) Statistics Canada, Labour Force Survey, Cansim Table 282-0038




Source: Updated Chart B in Drolet (2011) Statistics Canada, Labour Force Survey, Cansim Table 282-0038

14. **Structural changes** in the Canadian economy – like a shift away from manufacturing jobs and a decline in unionization – had a disproportionately larger impact on men. In recent years, the male-female unionization gap has disappeared (Chart 6).




*Source*: Chart D in Drolet (2011)

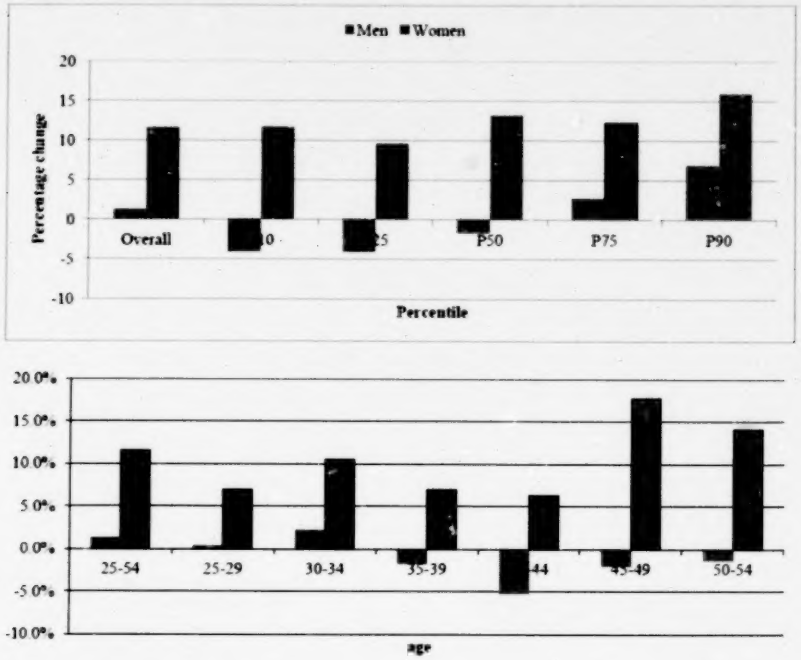
## IV. Women's wages grew faster than men's

15. Before changes in the wage differences *between* men and women over time are addressed, changes in the relatively hourly wage rates *among* men and *among* women must be documented.

16. On average, women's real wages increased by 11.6 per cent between 1988 and 2008. Increases occurred across all age and wage groups, the most dramatic among women aged 45 to 49 (17.8 per cent) and those at the higher end of the wage distribution (16.0 per cent) (Chart 7).

17. The situation for men is quite different. Overall, their real wages increased by 1.3 per cent between 1988 and 2008. However the changes were not consistent across age and wage groups.

**Chart 7: Percentage change in real hourly wages, by sex, age 25-54, 1988-2008 CANADA**




*Source:* Chart E in Drolet (2011)

## V. Evolution of the unadjusted wage gap: 1988-2008

18. The ratio of women's to men's average hourly wages rose from 0.757 to 0.833. In other words, the unadjusted gap narrowed by 7.6 percentage points (Drolet, 2011).

19. The wage gap narrowed throughout the wage distribution but it is at the lower end of the wage distribution where the gap shrank the most (by 11.5 percentage points) and the upper end where it shrank the least (6.7 percentage points). The trend noted at the lower end of the pay scale corresponds to other results, namely, the gap shrunk among part-time workers and clerical workers.

20. Although women increased their representation in high-wage occupations, like management positions, throughout the period, the wage gaps in these occupations are larger than average. This is not surprising since increasing representation is first apparent in lower level positions within occupations. Other research has shown that women continue to choose a more narrow range of occupations than men and they still represent a large portion of workers employed in the 20 poorest paid occupations (Cool, 2010). Women continue to be over-represented in health and education related occupations. The GWG is relatively small in these occupations with little change over the 1988-2008 period.

21. The wage gap among university educated workers remained at 16 per cent. The lack of movement in the gap is attributable to persistent differences in major fields of study chosen by men and women: women continue to outnumber men in education and humanities while men outnumber women in mathematics and engineering (Table 1).

Table 1
**Percentage of women among university graduates, by field of study, CANADA, 1992 and 2008.**

| *Field of Study* | *1992* | *2008* |
|---|---|---|
| | *percentage* | |
| Total | 56.4 | 60.0 |
| Architecture, engineering and related | 17.5 | 22.2 |
| Mathematics, computer and information services | 35.2 | 30.4 |
| Personal, protective and transportation services | 18.2 | 44.9 |
| Business, management and public administration | 51.4 | 53.0 |
| Agriculture, natural resources and conservation | 36.7 | 55.9 |
| Physical, life sciences and technologies | 45.6 | 57.3 |
| Humanities | 63.7 | 64.3 |
| Arts | 65.9 | 66.5 |
| Social, behavioural sciences and law | 59.3 | 67.0 |
| Education | 72.6 | 76.1 |
| Health, parks, recreation, and fitness | 68.0 | 77.0 |

*Source:* Women in Canada (2011). Data from Postsecondary Student Information System

22. Boudarbat and Conolly (2013) show that in certain fields of study, men earn more than women who graduate with the same degree. Analyzing cohorts of new post secondary graduates, Boudarbat and Conolly (2013) show that a pay gap exists among younger generations. For a given cohort of graduates, the pay gaps increase over time: that is, the pay gap is larger five years after graduation than it was two years after graduation. These pay gaps remain after differences in observable characteristics are taken into account.

## VI. Adjusted Gender Pay Gap: Point in time estimates

23. Most studies on the GWG relied on the assumption that wages were tied to the individual worker and this approach has dominated the empirical literature. The main reason for this approach was due to the type of data available to researchers – that is large household surveys containing an abundance of individual level information.

24. While there is no universally accepted set of conditioning variables that should be included, the literature firmly establishes that wage structures reflect a variety of human capital factors, (such as age, education and job tenure), demographic characteristics (marital status) and job characteristics (such as union status, part-time status, province). It is often

debatable whether industry and occupation should be included. Analyses that omit industry and occupation may overlook the importance of background and choice on wage outcomes while analyses that fully control or these variables may undervalue the significance of labour market constraints on wage outcomes. A similar argument can be made for the inclusion or exclusion of other variables of interest[5].

25. The wage structures of men and women are examined by estimating the relationship between hourly wages and a variety of observable worker characteristics in semi-logarithmic form[6]. Using these regression coefficients in combination with the mean value of the wage-determining variables, the Blinder- Oaxaca decomposition technique is used to disaggregate the wage difference into an explained (based on gender differences in observable productive characteristics) and an unexplained component (resulting from gender differences in the return that different variables command in the labour market)[7]. The male wage structure is used as the comparative wage structure[8].

26. Notable findings from Drolet (2002a) include:

- The portion of the wage gap attributable to differences in work experience is severely underestimated when potential work experience (=age-number of years of schooling – 6) is used instead of actual experience[9]. This is due to the fact that there is little gender difference in potential experience (about 0.4 years) but a significant gender difference in years of full-year, full-time equivalent experience (about 3.9 years). Since wages increase more for each year of FYFTE experience, this will explain more of the gender difference in wages.
- Gender differences in educational attainment *reduce* the explained component of the GWG (by at most 5 per cent) while gender differences in major field of study *increase* the explained component (by about 5 per cent). Not surprisingly, the effect of occupation diminishes when major field of study is used in instead of education level.
- Despite the exhaustive list and more accurate measures of worker productivity-related factors, about one-half of the wage gap remains unexplained.

[5] People differ in their preferences for particular types of work. Differences between man and women may reflect genuine differences in preferences, pre-labour market experiences, expectations or opportunities. It is often difficult to distinguish between choice-based decisions and differential treatment based on sex.

[6] The wage structures of men and women are estimated separately. The natural logarithm of hourly wages is used as the dependent variable. Each regression coefficient measures the return to the observable worker characteristics and is interpreted as the percentage change in hourly wage rates associated with a one-unit change in the explanatory variable.

[7] The regression models used in the decomposition analysis account for no more than half of the variation in the hourly wages of men and women. There are large differences in the intercept terms of the wage equations estimated for men and women signifying important differences that are unrelated to the choice of explanatory variables. The intercept term incorporates the effects of other factors that are either missing or not perfectly captured in the model and is also a function of the reference group from each set of dummy variables.

[8] Questions related to pay differentials are often framed in a manner that examines the extent to which women are paid the same as comparable men. For this reason, the male wage structure is often considered the 'competitive' wage structure. Adopting alternative pay structures (such as the female pay structure, or a weighted average based on the proportion of women and men in the paid labour market, or a pooled model) can lead to different interpretations of the components of the gender pay differentials. Drolet (2001) documents these differences in Table A1.

[9] Although the measure of actual labour marker experience is a welcome addition to the study of gender pay differentials, it is far from perfect. Drolet (2011) notes that information on the continuity of work experience, and the duration, frequency and timing of labour force withdrawals is missing. These factors influence the pay women receive in several important ways that may impact the GWG.

- After accounting for differences in a variety of observable characteristics, most notably actual labour market experience and major field of study, women's average hourly wage rate is 89.4 per cent of the men's average.

27. While the importance of human capital characteristics in the wage determination process has been firmly established, evidence documenting the importance of the workplace (other than inter-industry and firm size differentials) is sparse. Even more sparse is evidence on the contribution of various workplace practices in explaining the GWG.

28. Drawing on matched employee-employer data from the Canadian Workplace and Employee Survey, Drolet (2002b) documents the importance of workplace characteristics in explaining the GWG. Notable findings include:

- The GWG is smaller within workplaces than across workplaces. By comparing the earnings structures with and without workplace effects, the results show that women are disproportionately represented in low-wage workplaces: women earn about 15 per cent less than men when the workplace is not taken into account compared to 8 per cent less when controls for the workplace are included.
- The impact of education and work experience on wages is smaller when account is taken of the workplace to which the worker belongs. This suggests that some of the individual variation with respect to education and experience arise from the fact that workplaces offer widely varying returns to education and experience.
- The workplace accounts for more of the GWG than the characteristics of the worker.
- The workplace part-time rate acts as a proxy for the percentage of females in the workplace. It shows a large, negative wage impact. The gender difference in elasticity is the result of the gender difference on the proportion of part-time workers at the workplace and not he result of a gender difference in returns to the workplace part-time rate.
- After accounting for differences in a variety of observable worker and workplace characteristics, women's average hourly wage rate is 92.6 per cent of the men's average.

## VII. Evolution of the adjusted gender wage gap: 1988-2008

29. The evolution of the adjusted gender wage gap is documented in Baker and Drolet (2010) and Drolet (2011). These studies take advantage of wage data from a number of household surveys. While these data cover a long period of time, are nationally representative, have been harmonized to provide consistent concepts over time, the data are not as rich as those used in the previous analysis. Missing from this analysis is actual labour market experience, major field of study and the importance of the workplace in explaining the GWG.

30. The adjusted gender wage ratios for 1988 – 2008 are depicted in Chart 8 using results from Baker and Drolet (2010) alongside the ratios depicted in Chart 1. The adjusted differential refers to women's hourly wages expressed as a percentage of men's hourly wages after controlling for differences in observable characteristics such as age, education level, province, union status, tenure, occupation and industry.

*Source:* The adjusted ratio is calculated using results from Baker and Drolet (2010), Table 5, Specification 3.

31. The key findings from Baker and Drolet (2010) and Drolet (2011) are:

(a) The 'unadjusted' wage ratios tend to **overstate** the change in the gender wage ratio. That is, between 1988 and 2008 the 'unadjusted' gender wage ratio narrowed by 7.6 percentage points compared to 4.2 percentage points based on the 'adjusted' ratio of female-male average hourly wages.

(b) The wage gap is less and less the result of the differences between men and women in terms of their productive characteristics (or the explained component) but rather the wage gaps are increasingly due to differences in the rate or return men and women receive from these similar characteristics (or the unexplained component).

The 'adjusted' wage ratio was 4.4 percentage points higher than the 'unadjusted' ratio in 1988 but by 2008, there is little meaningful difference. Several interpretations are possible. First, men and women were simply paid more equally in 2008 than in 1988. Second, a widespread convergence in unobservable characteristics of men and women may have taken place (Beller and Blau, 1988; Ashraf, 1996). If men have, on average, greater endowments of these omitted variables, but over the period women have improved their endowments, then the narrowing of the wage gap may be partially attributable to a widespread decline in the difference in unobservable, productivity-related characteristics. This would certainly be the case for actual labour market experience. Third, attitudes toward women at work changed. Consequently, improvements in women's access to and their ability to acquire higher paying jobs may help to explain the convergence in returns even after accounting for occupation and industry.

(c) An alternative perspective on changes in the wage gap over time is provided by a dynamic Blinder- Oaxaca decomposition whereby the explained component refers to the relative changes in the productive characteristics of men and women and the unexplained component refers to the relative changes in the price these characteristics command.

According to Baker and Drolet (2010), almost 60 per cent of the reduction in the wage gap between 1981 and 2008 can be accounted for by changes in the wage-determining characteristics of men and women. While no one characteristic dominates, significant increases in the proportion of women with university degrees and changes in the occupations in which men and women work play leading roles.

In a related article, Drolet (2011) adds information on the factors contributing to the narrowing of the gender wage gap within age groups since compositional changes occurred

differently for workers of different ages. Among older workers (aged 50+), longer job tenure for women and shifts in occupation helped to explain why the wage gap closed. Higher educational attainment and the movement away from low paying occupations towards higher paying occupations contributed to the growth in the real wages of young women (aged 25-29). Structural changes in the economy, particularly the drop in union coverage and changes in the pay structure within some industries, had a larger impact on the wages of young men.

(d) In many dimensions, women have an advantage over men. If women commanded the same returns to those characteristics as men, women would receive higher – not lower – wages than men. The most significant exception is in the industrial distribution of men and women. Here, men possess the advantage over women.

## VIII. Is there a declining correlation between wage gap and age?

32. One clear result from analyses based on cross-sectional data is that the wage gap increases with age. Reading across the rows of data in Table 2, there are larger wage gaps among older workers and smaller wage gaps among younger workers in each year. Since women's characteristics have changed significantly since the earlier cohorts entered the workforce, at any point in time, older women's characteristics will be quite different from those of younger women. Women's characteristics are more similar to men's early in their careers and may diverge due to differing occupational and career interruption decisions. When combined, the large GWG among older workers and the smaller GWG among younger workers are easily explained.

Table 2
**Gender wage gap, 1988-2008**

| | *All* | *25-29* | *30-34* | *35-39* | *40-44* | *45-49* | *50-54* | *Age 25-29 vs Age 50-54* |
|---|---|---|---|---|---|---|---|---|
| 1988 | 0.243 | 0.154 | 0.206 | 0.232 | 0.264 | 0.319 | 0.355 | 0.201 |
| 1998 | 0.189 | 0.099 | 0.149 | 0.195 | 0.192 | 0.250 | 0.251 | 0.152 |
| 2008 | 0.167 | 0.099 | 0.142 | 0.163 | 0.175 | 0.216 | 0.193 | 0.094 |
| 1988-2008 | -0.076 | -0.056 | -0.064 | -0.068 | -0.089 | -0.103 | -0.103 | 0.107 |

*Source:* Selected results from Table 1 in M. Drolet (2011).

33. Although there is a correlation between the wage gap and age in all years, this correlation becomes smaller in each successive year. Reading down the columns of data in Table 2 the gender wage gap was 20.1 percentage points smaller among workers aged 25-29 than among workers aged 50 to 54 in 1988. By 2008, the difference in the wage gap between younger and older workers shrank to 9.4 percentage points.

34. The weakening correlation between the wage gap and age suggests a 'cohort replacement effect': as younger cohorts replace older cohorts, the GWG declines because the gap is smaller in new cohorts than those that preceded them.

35. But this comparison is made between workers from different birth periods. To answer the question: "Does the GWG increase as workers age?", a synthetic cohort approach is undertaken. By using repeated cross-sectional surveys, the change in the GWG for different workers in different birth periods can be tracked over time by reading Table 21 diagonally. As long as the cross-sectional sample is representative, this approach should approximate changes in the GWG over time within the same birth period.

36. Using this approach shows that cross-sectional data tends to overstate the correlation between age and the GWG. For example, the GWG was 15.4 percentage points among workers aged 25-29 in 1988. By 2008, when the cohort was aged 45-49, the GWG was 21.6 percentage points. These numbers show that the wage gap widened by 6.2 percentage points over 20 years for the 1988 cohort of workers aged 25-29. This is quite different from the cross-sectional evidence in 2008 where the CWG among workers aged 45-49 in 2008 was 11.7 percentage points higher than among those aged 25-29. Repeating the same exercise for other age groups casts further doubt on the strength of the correlation between age and the GWG.

37. These findings suggest that for at least some cohorts, part of the narrowing of the wage gap is attributable to the fact that the wages of men and women no longer diverged as they aged.

## IX. The role of changing selection bias

38. The issue of sample selection bias becomes important since the main focus is to compare how women performed relative to men over a twenty year period.9 Since women's employment rates were lower in the past, the possible contribution of changing participation rates to the narrowing of the gap should be explored. Intuitively, one may think that the substantial change in women's employment rates would be associated with selection issues. According to Beller and Blau (1988) there is no *necessary* relationship between changes in the labour force participation and selectivity bias. They suggest that changes in the labour force participation rates are one of many potential factors that may cause a change in the overall credentials of women in the labour force relative to men over the period.

39. What impact does the changing employment rate of Canadian women have on the narrowing of the GWG? For instance, suppose those women working in the late 1980s had 'above average' earnings potential relative to those women not working in the late 1980s. As women's employment rates increased, more women with average or below average earnings entered the labour marker. This would represent a change in the selection bias and would alter the measurement of the wage gap.

40. To isolate the impact of changing selection bias, wages must be linked to a consistent mix of characteristics at different points in time. Baker et al (1995) illustrate a technique to control for changing selection biases that may affect comparisons of the unadjusted differential over time. The technique can be extended to make assumptions about unobserved characteristics.

41. After selection bias is taken into account, the adjusted gap shrinks more than previously reported for 1988 to 2008: an additional 1.6 percentage point increase over the 7.6 percentage point change in the unadjusted gap (Drolet, 2011). This indicates that the average skills of new entrants in the labour market command lower wages than those who participated in both years. If this assumption is extended to unobservable characteristics, the gap shrinks an additional 5.1 percentage points compared to the change in the unadjusted gap. Evidence of selection effects by age provide even further evidence that the correlation between the GWG and age is overstated in cross-sectional tabulations.

## X. Concluding comments

42. Pay differences between men and women have attracted considerable attention from both the general public and policy makers. Understanding the determinants of women's labour market outcomes, in a period of substantial structural changes and policy intervention requires analysis from a number of different perspectives. The empirical

evidence on these outcomes has important implications on the potential scope for different policy interventions. Policy analysts judge the effectiveness of Canadian policy initiatives such as equal pay (including pay equity), equal opportunity (including employment equity) and family friendly policies (including maternity and parental leave) by the evolution of the gender pay gap.

43. The findings presented here provide some insight into the functioning of the Canadian labour market: the GWG early in one's career is an increasingly good predictor of the GWG throughout a generation's working life.

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